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Comparative Clinical Effects of Early Pharyngostomy Alimentation and Intravenous Fluid Infusion following Oesophageal Transection and Anastomosis in Nigerian Breeds of Dogs

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SUMMARY

Twelve adult Nigerian breeds of dogs were used to compare the clinical responses of dogs alimented through pharyngostomy tubes (PGTs) with those maintained on intravenous infusion (50:50 mixture of Ringers lactate and 5% dextrose saline) during the first 14 days following oesophageal transection and anastomosis (OTA). The dogs were assigned to two groups (n=6), the pharyngostomy tube (PGT) group and the intravenous fluid infusion (IVF) group (n=6). Dogs in both groups underwent routine OTA. The PGT group was fed blanched processed dog food at 70g/kg body weight for 14 days through PGTs, while the IVF group was maintained on intravenous fluids at a dose of 70 mL/kg body weight daily also for 14 days post operatively. The postoperative complications observed in both groups showed that the mortality rate in the IVF group (83.3%) was significantly ($P < 0.05$) higher than in the PGT group (16.7%). Vomiting and leakages at the site of oesophageal anastomosis did not differ significantly between the groups. Cervical swelling was observed in two dogs (33.3%) in the IVF group, while tenesmus and displacement of the tubes were recorded in 66.6% and 100% respectively of the dogs in the PGT group. It is concluded that feeding dogs which had undergone OTA through PGTs during the immediate postoperative period reduces their morbidity and mortality; and shortens the recovery period when compared with similar dogs maintained solely on intravenous fluids.

Keywords: Oesophageal, Transection, Anastomosis, Pharyngostomy, Complications, Morbidity, Mortality.

INTRODUCTION

Oesophagotomy is an acceptable treatment option for the removal of oesophageal foreign bodies and mild oesophageal stenosis (O'Connor, 2005). Although it has the potential of becoming life threatening (Houlton *et al*., 1985; Kyles,

2003) more complicated oesophageal disorders such as congenital obstructions, acquired discrete strictures, severe localized injuries, diverticula, perforations and neoplasias may require management with partial or total oesophagectomy (OE) and varying degrees of or no gastric mobilization to the cervico-thoracic region (Rosin, 1975; Slatter, 1993; Orton, 1995; Shield *et al*., 2005; Sutton *et al.*, 2016).

Although surgery can be performed successfully on any portion of the oesophagus (Slatter, 1993), oesophageal surgery is historically associated with higher rates of post-surgical complications than surgery on the gastrointestinal tract (Bonayard *et al*., 1992). This high rate of complications is accounted for by the absence of a serosal layer on the oesophagus which delays the formation of a quick seal at the site of the oesophageal surgery (Orton, 1995), the segmental blood supply to the oesophagus, the absence of an omentum on the oesophagus, and the constant motion of the oesophagus during deglutition which causes considerable tension at the suture line of an oesophageal anastomosis (OA) (Pavletic, 1981). Despite these factors, oesophageal surgeries can be successful if the oesophageal tissues are handled atraumatically, tissue contamination is kept at a minimum, and the appropriate suture material and patterns are employed in the anastomosis of the transected oesophagus (Orton, 1995).

Mortality rates associated with oesophageal surgeries range from 1.8% to 13% (Bruno *et al*., 2003; Hsu *et al*., 2004; Simon *et al*., 2005; Viqar *et al*., 2008; Sutton *et al.*, 2016). Other major complications associated with oesophageal surgeries are dehiscence, stenosis and leakage of luminal contents at the site of the OA (Parker and Caywood, 1987; Flanders, 1989). Leakages at the site of OA have been attributed to peri-operative malnutrition, diabetes mellitus, age, hypotension, hypoxaemia and the use of cytotoxic agents (Turkyilmaz, *et al*; 2009). Most complications of oesophageal surgeries may be eliminated if the procedure is carried out with high degree of fineness (Whooley, *et al*; 2001).

Human and animal patients intended for oesophageal and most gastrointestinal tract surgeries are usually denied enteral feeding for varying postoperative periods. They are rather sustained on water and electrolytes through parenteral administration of crystalloids. This has been associated with malnutrition, severe weight loss, negative catabolism associated with tissue damage (Page *et al*., 2002), gastrointestinal mucosal atrophy, lymphopaenia, catheter sepsis and bacterial translocation (Kawasaki, *et al*., 2009) in such patients. On the other hand, intravenous fluids as the sole source of nutrition for surgical or traumatic patients have been shown to be of very negligible value (Heslin *et al*., 1997; Page *et al*., 2002; Kawasaki *et al*., 2009). In humans for instance, enteric feeding through catheter feeding jejunostomy (Dekany *et al*., 1977) and naso-jejunostomy tubes (Page *et al*., 2002) are credited with better postoperative outcomes than the intravenous adminstration of crystalloids.

Post-operative nutrition of OA patients via gastric and ilial tubes has been reported in humans (Dekany *et al*., 1977; Page, *et al*., 2002). The authors are not aware of any report comparing the survival of Nigerian local breeds of dogs fed through a pharyngostomy tobe and maintained by intravenous fluid only, following oesophagotomy..

This study was conducted to compare the clinical responses in dogs alimented through PGTs with

those maintained on intravenous administration of crystalloid fluids following OTA.

MATERIALS AND METHODS

This study was conducted in accordance with the ethical standards in the 1964 Declaration of Helsinki, as operational in Nigeria. The randomized controlled trial design was used for this study.

Twelve clinically healthy Nigerian local dogs (6 males and 6 non-pregnant, non-lactating bitches), aged between12 and 18 months and weighing 8.0±2.3kg were used for this study. The age of the dogs was estimated by dental examination (Aiello, 1998). They were purchased from a local market in Umuahia, Abia State, Nigeria. They were housed individually in the kennels, and fed once daily on household food. Water was provided *ad libitum*. The dogs were allowed a period of four weeks to acclimatize to the local conditions. They were dewormed with ivermectin (Ivermectin 2%, Kexing, China)) at a dose of 0.4 mg/kgand treated against ticks and tick-borne haemo-parasites prior to the experiment. None of the dogs was adjudged to be suffering from any ailment prior the commencement of the experiment. Using the method as described by Coles (1986). a complete blood count was carried out, and the results showed that the dogs had normal haematological values (Royd, 1984) prior to the commencement of the study.

The dogs were randomly assigned to two groups (n = 6) each, the PGT group and the IVF group. In both groups, food and water were withheld for 24hrs and 12 hours, respectively, prior to surgery. The dogs were premedicated with atropine sulphate (Pauco Pharmaceutical Industry Nigeria Ltd, Nigeria) and xylazine (Kepro, Holland) at doses of 0.04mg/kg and 2mg/kg body weight intramuscularly (i.m.) respectively (Brearley and Heath, 2005).

The ventral aspect of the neck from the larynx to the thoracic inlet was clipped and the skin scrubbed using a 0.003% solution of chlorhexidine (Nanz Med Pharma Private Limited, Delhi). The dogs were anaesthetized with ketamine hydrochloride (Rotexmedica, Germany) at the dose of 15mg/kg body weight, i.m. Anaesthesia was maintained with ketamine at of 7mg/kg i.m as required (Hall, *et al*., 2001).

Each dog was intubated with endotracheal tube (ID 7.0, Medifield Equipment and Scientific Ltd, England). An oesophageal tube was inserted per os to aid in the identification of the oesophagus prior to its transection. The dog was then positioned and secured in dorsal recumbency. Approximately, a 10cm long ventral midline skin incision was made extending caudally from a point 2 -3 centimeters caudal to the larynx. The sternocephalicus and sternohyoideus muscles were separated in the midline and an OTA was performed using standard procedures as described by Venugopalan (2000). At the completion of anastomosis the suture line was checked for leaks by withdrawing the oesophageal tube to a point cranial to the oesophageal suture line and passing 20mls of water through the tube. The water was milked caudally through the oesophgeal suture line. Effusion of water through the line of anastomosis was regarded as anastomotic leakage. Such leakages were repaired by the placement of 1-3 additional interrupted sutures at the leaking sites.

Dogs in the IVF group were maintained solely on a 50/50 mixture of 5% dextrose saline and Ringer's lactate solution administered intravenously at a dose of 70mL/kg bwt twice

daily for the first 14 days postoperatively via 20 G intravenous cannulas (Lakhani Medicare Pvt. Ltd, India) inserted into their cephalic veins. In the dogs in the PGT group, PGTs were inserted into the oesophagus immediately following OA before the access incisions on the muscle layers and skin of the cervical region were closed routinely as described by Slatter (1993). The PGT group was fed blended processed dog food (Binggo, UAC, Nigeria) at the rate of 70g/kg body weight through the PGTs once daily for 14 days postoperatively.

Procaine Penicillin (Laborate Pharmaceutical, India) and streptomycin (Entomycin® Zhejiang Jinling Tianfeng Pharma, China) were administered to all the dogs for five days post operatively at the doses of 10,000 I.U/kg and 20 mg /kg i.m. respectively. Post-operative pain was managed by the intra muscular administration of Piroxicam (Greenfield Pharmaceutical, China) at the dose of 0.3mg/kg for three days.

The dogs were observed for fourteen postoperative days and the occurrence of vomiting, leakage from the site of the oesophageal anastomosis (observed as discharges along the site of skin closure), cervical swelling (anywhere on the ventral aspect of the neck), swelling at the point of entry of the PGT, dislodgement of the PGT, pyloric obstruction with swallowed PGTs, discharge from the point of PGT placement, tenesmus and mortality were recorded.

The association between the placement of PGTs and the occurrence of mortality was determined using Fisher's Exact Test, using Statistical Package for Social Sciences (SPSS), and values of $P < 0.05$ were considered significant for association.

RESULTS

The incidence of vomiting, leakages at the site of OA and deaths as observed in PGT and IVF groups were presented in Figure 1. These complications occurred between days 1 and 14 postoperatively. There was an association ($p < 0.05$) between the placement of PGT and survival rate of patients, with the mortality rate in the IVF group being significantly higher than in the PGT group. However, there was no association ($p \geq 0.05$) between the occurrence of vomiting and anastomosis leakages and the placement of PGTs. Cervical swelling was observed in the IVF group, while swelling at the pharyngostomy site, dislodgement of PGT, tenesmus and pyloric obstruction were observed in the PGT group only. The postoperative days in which these complications occurred, the number of dogs involved, the interventions instituted and their outcomes are presented in Table 1.

DISCUSSION

Most dogs requiring management with oesophagectomy are usually presented in various degrees of compromised clinical states and pose considerable management risks because of the attendant pytalism, regurgitation and continued fluid deficits particularly in paediatrics and geriatrics. In some of such patients, a partial or rarely total oesophagectomy is required with considerable mobilization of the remaining segments of the oesophagus. In this study no segment of the oesophagus was resected.

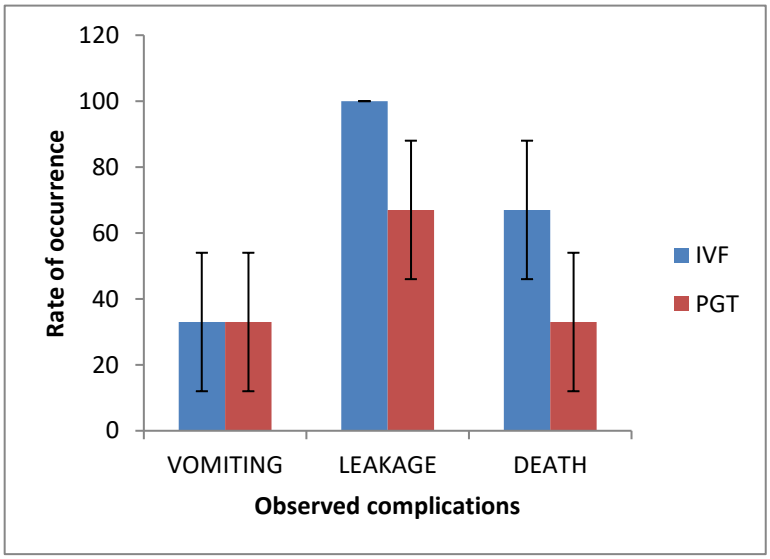

Figure 1: Rate of occurrence of post-operative complications observed in the IVF and PGT groups. ***Different superscripts indicate association (p<0.05) between complications and placement of PGTs***

TABLE 1: Summary of complications and final outcomes in dogs following OTA and maintenance via PGTs and IVF

Complications	Postoperative day of occurrence	Numbers involved PGT group	Numbers involved IVF group	Intervention	Outcome
Cervical swelling	1	0	2	None	Death within 24hrs
Swelling at site of PGT placement & dislodgement of PGTs	4-6	6	NA	Replaced within 12 hrs of dislodgement	Retained thereafter till end of experiment in all cases
Tenesmus	3	4	Nil	None	Resolved without any specific management
Pyloric obstruction	2	2	NA	Gastrotomy	Obstruction was relieved.
Mucoid discharge from site of PGT placements	1-6	2	N/A	Cleaning and antibiotic dressing	Resolved successfully

The most commonly reported complications of OE in humans are respiratory failure and dehiscence of the anastomosis, both of which are reported to be fatal (Michelet, *et al*., 2005). Complications such as leakage at the site of anastomosis,
regurgitation and dysphagia have been reported in dogs following oesophageal surgeries(Mahdi, 2011). The rate at which respiratory failure and anastomotic dehiscence occur is claimed to be directly related to the finesse in the execution of the oesophageal surgery (Whooley, *et. al.*, 2001).
The significantly higher survival rate observed in the PGT than the IVF group agrees with the report by Whooley (2001) and corroborates the notion that enteric feeding is superior to IVF administration for the maintenance of patients that have undergone oesophagectomy in humans. This is thought to be due to the early alimentation in the PGT group which apparently maintained intestinal integrity, induced anabolism as against catabolism, counteracted bacterial trans- and re- locations and subsequently reduced the stress response in the PGT group (Page *et. al*., 2002; Lassen, *et al*., 2008). These, put together, clearly improved the survival rate of the PGT group over the IVF group.
The occurrence of leakages of oesophageal contents at the site of OA in both groups suggests that creating a by-pass for feeding, or preventing oesophageal motion during deglutition may not completely prevent leakages from the OA site. Such leakages have been reported to be a major cause of post-operative mobitity and mortality in humans following oesophagectomy.
The dislodgement of the PGTs recorded in the PGT dogs has been reported by earlier workers (Slatter, 1993; Summer *et al*., 2000) and seems to be preventable by adequate anchorage of the PGTs at their stomas. Their prompt replacement ensured that there was little disruption in alimentation. The ultimate effects of the dislodgement of the PGTs or vomiting, particularly in respect to the times they occurred during the immediate post-operative period, on the final post-operative outcome of such cases is not clear. However, they certainly imposed a higher responsibility for post-operative case management than would otherwise have been necessary. The occurrence of vomiting within the first few post-operative days in dogs subjected to OA in this study agrees with the observations of Strombeck, (1990), Collard *et al.*, (1998), Cheryl and Theresea, (2007).

CONCLUSION

In conclusion, placement of PGTs after oesphagectomy and OA resulted in reduced postoperative morbidity and mortality because of the immediate postoperative feeding of the animals. The complications attributable to oesphageal surgery were present in both groups, but they were less lethal in the PGT group because of the immediate postoperative feeding of the dogs through the PGTs. It may be necessary to compare this with other methods of enteral alimentation in dogs to enable conclusions to be drawn about the effectiveness of the different techniques in preventing morbidity and lowering mortality rates on dogs subjected to OTA.

REFERENCES

ASLAM, V., BILAL, A., KHAN, A., BILAL, M., ZAINULABIDEE, N. AND AHMED, M. (2008): Gastroesophageal anastomosis: single layer versus double layer technique –an experience on 50 cases. *Journal of Ayub Medical College Abbottabad* **20**(3). 6-9.

BREARLEY, J. C., & HEATH, S. E. (2005). *The Veterinary Formulary* (6th ed.). (y. Bishop, ed.) Grayslake, U.S.A.: Pharmaceutical Press.

BONAYAD, H., CAYHOOD, D.D., ALYAKIRE, H,, LIPOWITZ, A.L. AND LIEPOLD, H.W. (1992). Surgical reconstruction of the partial circumferential esophageal defects in the dog. *Journal of Investigative Surgery* **5,** 327-342.

BRUNO, W., JAN, J., FOLKE, J., CHRISTER, S.H. AND THOMAS, Z. (2003). Cervical or thoracic anastomosis after esophageal resection and gastric tube reconstruction. A prospective randomized trail comparing sutured neck anastomosis with stapled intrathoracic anastomosis. *Annals of Surgery* **238**, 803-814.

CHERYL, S.H. AND THERESEA, W.F. (2007). Surgery of the digestive system. in: *Small Animal Surgery*. 3RD edition (*WF THERESEA, SH CHERYL, LJ ANN, SS KURT, BS HOWARD, DW MICHEAL B ANNE, LC GWENDOLYN*, CV MOSBY, MISSOURI. pp: 339-527.

COLLARD, J.M., ROMAGNOLI, R., GONCETTE, L., OTTE, J.B., AND KESTENS, P.J. (1998). Terminalized semi mechanical side-to-side suture technique for cervical esophagastrostomy. *Annals of Thoracic Surgery,* **65**: 814-817.

COLES, E. H. (1986). Veterinary Clinical Pathology 4th Ed. W.B Saunders Company. Philadelphia, London.

DEKANY, H., CARNVALE, N., GARVEY, J. AND MOSS, C. (1977). Postoperative nutritional support using needle catheter feeding jejunostomy. *Annals of Surgery*, 165-170.

FLANDERS, J.A. (1989). Problems and complications associated with esophageal surgery. *Problems in Veterinary Medicine* **1**(2), 183-94.

HALL, L.W., CLARKE, K.W. AND TRIM, C.M. (2001). *Veterinary Anaesthesia (10th Edition)*. Hacourt Publishers Ltd, England. Pp 123-125.

HASLIN, M.J., LATKANY, L., LEUNG. D., BROOKS, A.D., HOCHWALD, S.N., PISTERS P.W. (1997). Early enteral feeding after resection of upper gastrointestinal malignancy. *Annals of Surgery* , **226** (4), 567-580.

HASSAN, A.Z. AND HASSAN, F.B. (2003): *Introduction to Veterinary Practice*. Ahmadu Bello University Press Limited, Nigeria. Pp 75-76

HOULTON, J.F., HERRITAGE, M.E., TAYLOR, P.M. AND WATKINS, S.B. (1986). Thoracic esophageal foreign bodies in the dog: a review of ninety cases. *Journal of Small Animal Practice* **26,** 521-536.

HSU, H.H., CHEN, J.S., HUANG, P.M., LEE, J.M. AND LEE YC (2004). Comparison of manual and mechanical cervical esophagogastric anastomosis after esophageal resection for squamous cell

carcinoma: a prospective randomized controlled trial. *European Journal of Cardiothoracic Surgery* **25**,1097–101.

KAWASAKI, N., SUZUKI, Y., NAKAYOSHI, T., HANYU, N., NAKAO, M., AND TAKEDA, A. (2009). Early postoperative enteral nutrition is useful for recovering gastrointestinal motility and maintaining the nutritional status. *Surgery Today* **39**, 225-230.

KYLES, A.E. (2003). Surgical diseases of the esophagus. In: *textbook of small animal surgery, 3rd Edition (dh Slatter, Editor).* WB Saunders Co, Philadelphia. 573-591.

LASSEN, K., KJAEVE, J., FETVIET, T., TRANE, G., SUGURDSSON, H.K. AND HORN, A. (2008). Allowing normal food at will after major upper gastrointestianl surgery does not increase morbidity. A randomized multicenter trial. *Annals of Surgery* **247** (5), 721-729.

MICHELET, P., D'JOURNO, X.B., ROCH, A., PAPAZIAN, L., RAGNI, J., AND THOMAS, P. (2005). Perioperative risk factors for anastomotic leakage after esophagectomy: Influence of thoracic epidural analgesia. *Chest* **128,** 3461–3466.

O'CONNOR, J. (2005). *Dollar's Veterinary Surgery (4th Edition)*. Cbs Publishers and Distributors,New Delhi. Pp 315.

ORTON, E.C. (1995): Esophagus. In: *Small Animal Thoracic Surgery. (ce orton. Editor)*: Williams and Wilkin, Baltimore. Pp 117.

PARKER, N. AND CAYWOOD, D. (1989). Surgical diseases of the esophagus. *Veterinary Clinics in North America* **17,** 333.

PAGE, R., OO, A., RUSSELL, G. AND PENNEFATHER, S. (2002). Intravenous hydration versus naso-jejunal enteral feeding after esophagectomy: a randomized study. *European Journal of Cardio-thoracic Surgery* **22**, 666-672.

PAVLETIC, M.M. (1981). Reconstractive esophageal surgery in the dog: a literature review and case report. *Journal of the American Animal Hospital Association* **17**:435–442.

ROSIN, E. (1975). Surgery of the Esophagus. *Veterinary Clinics in North America* **5**:557–564.

SHIELD, TH.W, JOSEPH, L., PONN, R.B. AND RUSCH, V.W. (2005). *General Thoracic Surgery (6th Edition)*. Lippincott Williams & Wilkins, Philadelphia. Pp 2325-2340.

SIMON, L., DACITA, T.K., KAM-HO, W., KA-FAI, K. AND JOHN, W. (2005). A Single- Layer, Continuous, Hand-Sewn Method for Esophageal Anastomosis. *Archives of Surgery* **140,** *33-39.*

SLATTER, D. H. (1993): *Textbook Of Small Animal Surgery* (*2nd Edition*). WB Saunders Co., Philadelphia.

SUMMERS, A.N., LARSON, D.L., EDMISTON, C.E., GOSAIN, A.K., DENNY, A.D. AND RADKE, L. (2000). Efficacy of pre-operative decontamination of the oral cavity. *Plastic and Reconctructive Surgery* **106,** 895-900.

SUTTON, J.S., CULP, W.T.N., SCOTTI, K., SEIBERT, R.L., LUX, C.N., SINGH, A., WORMSER, C., RUNGE, J.J., SCHMIEDT, C.W., CORIE, J., PHILIP, H., SELMIC, L.E., NUCCI, D.J., MAYHEW, P.D. AND KASS, P.H.

(2016). Perioperative morbidity and outcome of esophageal surgery in dogs and cats – 72 cases (1983 – 2013). JAVMA. 249: (7), 787 – 793.

STROMBECK. D.R. (1990). *Small animal gastroenterology (2nd edition).* Stonegate Pub Comp, London. Pp: 84-121.

TURKYILMAZ, A., EROGLU, A., AYDIN, Y., TEKANBAS, C., MUHAREEM-EROL, M. AND KARAOGLANOGLU, N. (2009). The management of esophagastric anastomotic leak after esopagectomy for esophageal carcinoma. *Diseases of the Esophagus* **22**, 119-126.

WHOOLEY, B.P., LAW S., MURTHY, S.C., ALEXANDROU, A., AND WONG, J. (2001). Analysis of reduced death and complication rates after esophageal resection. *Annals of Surgery* **233** (3), 338-344.